Attachment 2

Estimating the Additional Cost of CLECs' Voice Grade Service

Introduction:

CLECs' ability to provide Voice Grade DS0 level local services using analog loops and their own switches has been the subject of much discussion in the course of the Triennial Review. This paper documents the cost drivers relating to the provision of such services and shows how the absence of a requirement that ILECs deliver a digital and packetized interface to the "last mile" facility, such as occurs with the ELP architecture, creates an insurmountable barrier to offering competitive facilities-based service to mass-market customers. In this context, mass-market customers are defined as customer locations that are economically served through the use of analog loops.

The cost figures employed in this paper are not necessarily those of any particular CLEC, as those will vary based upon the particular locality in which the CLEC operates, its choice of equipment vendor, the volume of purchases it makes and the particular business strategy it employs. Nevertheless, this paper focuses upon the *minimum* costs that a CLEC can expect to incur even if its physical assets are fully utilized to connect its customers to its own switch and it incurs the middle range of ILEC charges for collocation, transport and hot cuts. Where possible, likely ranges of these estimates are identified and scaling considerations for equipment elements are set forth.

Despite the detail set forth in this paper, one point is inescapable: the current state of technology and ILEC pricing impairs CLECs by creating unit cost disadvantages that make facility-based local service offerings to most mass-market customers (whether residential or small business) an economic non-starter. For the incumbent, the entirety of the CLEC cost structure discussed in this paper represents a few feet of 24-gauge copper wire connecting the vertical side of the main distribution frame to the horizontal side of the frame, which is wired to the incumbent's switch port. Although individual unit cost assumptions set forth in the following analysis might be modified so as to yield a modestly lower unit cost, such adjustments will not likely produce a material impact upon the overall total unit cost impairment, unless they reflect operating procedures other than those typically employed by industry participants or reflect "exceptional" conditions that are not likely to be routinely experienced in the "real" world.

Finally, it must be emphasized that this paper only seeks to quantify the *minimum* cost disadvantage experienced by a facility-based CLEC that attempts to connect a loop it obtains from the incumbent to its own switch. Accordingly, the paper does not seek to quantify the total cost of providing service, or necessarily represent all costs, equipment utilizations, or engineering practices that should be applied to the evaluation of incumbent LECs' costs.

To facilitate the analysis of the CLECs' cost impairment, the discussion below is divided into three primary components: (1) the cost of preparing the loop for transport out of the ILEC LSO, (2) the cost of connecting the ILEC local serving office ("LSO") to the CLEC switch, and (3) the cost of connecting the customer to the CLEC's network.

Costs of preparing the loop for transport:

Telecommunications is possible only if the information content of the signal that enters one end of a facility is intelligible at the far end of that same facility. Accordingly, transmission systems must be designed so that either (1) the conductor over which the signal travels is sufficiently short so the signal quality does not degrade to an unintelligible level, or (2) intermediate equipment is inserted to regenerate/amplify the signal to overcome such losses. In the case of incumbent LECs' local loop plant, the choice was generally made to employ relatively short copper facilities. While this was a prudent choice for monopoly incumbent LECs, it has serious cost implications for potential competitors who seek to offer service using the incumbents' loop facilities. In effect, the incumbents' loop plant has generally "consumed" all the permissible transmission loss by the time a loop facility terminates in a local serving office or LSO – the first point where a CLEC can practically access an analog loop. As a result, the CLEC must incur substantial costs to prepare the communications for transport to a different location, *i.e.,* the place where the loop will ultimately terminate on a CLEC local switch port. The cost of preparing -- or digitizing, concentrating and multiplexing -- the signal, is the largest single component of the cost disadvantage potential competitors must incur. The costs of preparing the loop for transport are reasonably subdivided into two categories: space and equipment.

Space Costs

Before a CLEC can deploy any equipment to prepare a loop for transport, it must rent space from the incumbent (in close proximity to the main frame) where it may deploy its equipment. This space is referred to as collocation.

Collocation space charges vary substantially by incumbent LEC, by state and by locality within a state. Some variation in space rentals is expected. The cost to obtain use of a square foot of land in lower Manhattan is substantially more, for example, than the comparable cost in Fargo, North Dakota. Furthermore, whether justified or not, other costs may cause variations in collocation costs, such as charges for power and other considerations such as asbestos mitigation or dual power feed requirements. It is not unreasonable to find the average cost of collocation to vary by an order of magnitude from a low cost market to a high cost one. Nevertheless, a reasonable estimate what is charged for physical collocation, based on AT&T's experience, is about $15.00 sq ft per month.[1]

[1] AT&T's experience is based upon what it is charged for more than 1,000 physical collocations. Examined at the LEC-LATA level, the average monthly costs varies more than 10-fold from a low of about $4 per square foot per month (*e.g.*, for SBC/SNET-CT-LATA 920, Qwest-NM-LATA 664, or Verizon-

Clearly, collocations can be used to serve more than just DS0 service. However, it is possible to avoid this complexity by establishing the minimum cost for the footprint of equipment required only for voice local service.[2] A fully equipped DLC requires 2.5 frames and can serve up to about 2,016 lines.[3] Thus, the floor space cost attributable to voice service represents a minimum cost (at 100% utilization) of $0.21 per line per month, not including the cost of space preparation and floor space cost loading for any other essential supporting equipment frames.[4] Loading for related DS0 equipment floor space consumption results in a minimum practical cost for physical collocation space of $0.35 per month per line.[5]

Note that achievement of these unit costs is highly dependent upon whether or not a CLEC could practically attain a volume of at least 4,000 to 5,000 local voice lines in an end office. Given that the average size of an RBOC end office is only about 17,000 local VGEs, assuming that a CLEC could place 4,000 to 5,000 lines on a DLC in an office implicitly assumes that a single CLEC could practically win a 24% market share in the average office. The current state of competitive inroads, particularly in the mass-market, indicates that such a win rate is exceedingly optimistic.

The monthly cost of collocation, however, is not the only space-related cost. Collocation cost preparation adds significant cost. For example, each increment of $100,000 in upfront cost for space preparation equates to a $2,223 a monthly cost.[6] Based on AT&T's experience, collocation non-recurring charges increases the cost to the range of $0.73 per month per line.[7]

NY-LATA 133) to a high of about $40/square foot per month (*e.g.*, for GTE-CA-LATA 750, or Verizon-NY-LATA 134).

[2] The estimate used here is highly conservative, because it assumes the *entire* collocation is efficiently utilized and imposes no cost penalty if it is not.

[3] For example, see the discussion of the LiteSpan 2000 equipment present in HAI5.3 input documentation.

[4] The calculation is 10 sq ft per frame * 5 frames * $15 per sq ft per month divided by (2*2,016*90% fill) lines with the result increased by 1% to account for non-income taxes.

[5] The calculation is ($0.209)*(10 racks required/6 DLC racks). Seven frames of DLC support 4,032 DS0 terminations and (at 4:1 concentration) require 2 DS3 terminations. This requires 2 bays of termination equipment, 1 bay for power distribution equipment and a fourth bay set aside for remote test equipment.

[6] The calculation is the EXCEL function @PMT(a,b,-c) for a monthly annuity from a present amount where "a" is the monthly interest rate, "b" is the life of the annuity in months, and "-c" is the present worth of the initial investment. The values used for "a", "b" and "c" were 22.02%/12, 8.0 years * 12 months and $100,000, respectively. The interest rate is pre-tax and the 8.0 year life assumption is the life of the digital circuit equipment placed within the collocation.

[7] The $0.35 per line per month figure (which did not include the collocation preparation costs) is multiplied by a loading factor of 2.085, which is the ratio of the monthly cost including collocation preparation ($8,546) to the monthly cost excluding preparation ($4,100).

Equipment Costs

Equipment required to accommodate DS0 voice services is of three main types: (1) digital loop carrier equipment (*i.e.*, the equipment necessary to digitize and concentrate the individual voice grade loops), (2) facility terminating equipment (*i.e.*, the cross-connection frames where the incoming voice grade loops terminate and the out-going DS3 level facilities terminate and equipment cross-connections are made) and (3) supporting infrastructure equipment (*e.g.*, the battery distribution fuse bay, and test equipment).

The digital loop carrier represents the largest single investment category. The cost inputs to the HAI Model (HAI 5.3) can be used to produce a reasonable proxy of this investment. The components of the DLC investment are summarized below:

Material Unit Costs (by line levels)					
Item	per 2016	per 672	per 224	per 4	per locaton
LSO& Node					
Common Control	$ 7,800.00	$ 2,200.00			
SONET firmware	$ 7,000.00				
LSO					
Channel Bank Assembly			$ 1,333.33		
CBA commons			$ 833.33		
frame		$ 300.00			
line cards				$ 192.00	
Node					
DSX		$ 800.00			
LSO materials	**$ 14,800.00**	**$ 2,500.00**	**$ 2,166.67**	**$ 192.00**	**$ -**
Node material	**$ 14,800.00**	**$ 3,000.00**	**$ -**	**$ -**	**$ -**

Labor Unit Costs (by line levels)					
Item	per 2016	per 672	per 224	per 4	location
LSO					
engineering	$ 1,760.00				
Install CBA plugs		$ 25.00			
rack		$ 110.00			
copper termination	$ 110.00				
test & turn up	$ 165.00				
Node					
engineering	$ 660.00				
Install common cards	$ 55.00				
rack	$ 165.00				
fiber terminations	$ 300.00				
test & turn up	$ 165.00				
DSX connections		$ 100.00			
LSO labor	**$ 2,035.00**	**$ 135.00**	**$ -**	**$ -**	**$ -**
Node labor	**$ 1,345.00**	**$ 100.00**	**$ -**	**$ -**	**$ -**
LSO total	$ 16,835.00	$ 2,635.00	$ 2,166.67	$ 192.00	$ -
Node total	$ 16,145.00	$ 3,100.00	$ -	$ -	$ -

lines	2016					
Units	1	3	9	504		
LSO Investment	$ 16,835.00	$ 7,905.00	$ 19,500.00	$ 96,768.00	$ -	$ 141,008.00
Node Investment	$ 16,145.00	$ 9,300.00	$ -	$ -	$ -	$ 25,445.00
	$ 32,980.00	$ 17,205.00	$ 19,500.00	$ 96,768.00	$ -	$ 166,453.00

Because the DLC can share common equipment, the average unit cost does not reach a minimum until one base and two expansion modules are in service. At that point, the

investment is $166,453 for the capacity to serve 2,016 lines. Note that this figure includes the companion terminal investment that would physically be placed at the CLEC switching node.

The preceding investment equates to a $3,700 per month investment recovery cost for a maximum of 2,016 lines.[8] Because it is impractical to have all lines in service at any one time, the actual maximum lines in service will be about 90% of maximum line capacity, or 1,814 lines. If this level is achieved (and again even this fill in a single end office is not generally practical for a single CLEC), the DLC-related cost will be at its minimum and equals $2.19 per month per line for the DLC alone.[9]

But more equipment is required in addition to the DLC. As discussed above, this includes termination equipment as well as power distribution and test equipment. HAI inputs do not explicitly identify DS0 or a DS3 termination costs in the central office. However, these costs can be approximated by using information obtained from supplier websites. For the purpose of this paper, DS0 and DS3 terminations costs were obtained from ADC website pricing information.[10] At maximum fill, this equipment adds about $0.10/line per month.[11]

The power distribution is largely a fixed cost for the collocation and, based on AT&T's experience, represents an investment of about $62,500. The remote test access equipment is somewhat volume sensitive, having a fixed cost of about $8,500 for every four fully equipped DLCs and a variable investment of about $1,400 for every 120 lines.[12] Fully equipped investment in support equipment generates a minimum average monthly cost of $0.32 per line.

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[8] The calculation is PMT[(22.02%/12),(8.0*12),-$166,453*(1-(0%))].

[9] The calculation is {[$3,700 + $166,453*(2%/12)]*(1.01)}/(2016*90%).

[10] The DS0 termination equipment costs $260 per panel, with each panel accommodating 200 terminations and with 39 panels accommodated in a single rack (7,800 terminations per rack at a list price of $10,140). *See* item Q43U2-0825X on the ADC website [www.ADC.com]. The DS3 termination cost was based on ADC item DSX 4B 24 7A, which has a capacity of 24 DS3s per 7-inch shelf. Six DLC racks (4,032 terminations) at 4:1 concentration require less than two DS3s for transport. Therefore, 6 DLC racks would only require 2 terminations on the DS3 panel, and the corresponding transport would account for another 2 terminations. Thus, a single DSX3 shelf was judged sufficient for the entire collocation and was assumed mountable in the same rack as the DS0 terminations. The list price for the referenced ADC item was $8,463.23 per shelf. For both the DS0 and DS3 terminations, a 50% discount from list was assumed.

[11] The investment is $8,436 (DSX3 panel) + $21,840 for 84 DS0 termination panels to accommodate the 4,590 DS0 terminations (21 panels for the loop termination, 21 for the DLC terminations, 42 for the CTAS connections) and $1,050 for the three frames to accommodate the terminations. Because a 50% discount from list was assumed, the investment is $15,663. This results in a monthly investment recovery of $348, maintenance of $26 and taxes liability of about $4. The total is $378 per month for 3,629 lines (4,032*90% fill) lines for a minimum cost of $0.10 per month per line.

[12] Computer-controlled test units and test access points must be deployed in order to provide remote test access. This can be accomplished by installing generally available (*e.g.,* Harris) test equipment, which would include one RTU ($7,500) and one TPE ($1,000) for every 4 DLCs. In addition, 1 CTAS unit ($1,362.50) is provided per 120 lines. Four DLC support 8,064 lines that, in turn, require 68 CTAS units.

Combining these categories ($2.19+$0.10+$0.43) results in a cost of $2.73 per month for the equipment necessary to digitize, multiplex and concentrate the loops for interoffice transport and another $0.73 for the space in which it is deployed, for a combined *minimum* average total of $3.46 per line per month for this cost component alone.

Backhaul Infrastructure Costs

In addition to the above costs, a backhaul infrastructure is necessary to provide the physical connectivity between the LSO where the competitor's DLC is located and the physical location of the CLEC switch. The infrastructure may include only self-provisioned facilities if the DLC and a self-provided facility exist in the same location. In this case, the backhaul costs would be a minimum of $0.21 per month per line.[13] Such instances of direct connection to self-provided facilities will be rare, however.[14] More frequently, the CLEC will need to hub lower density collocations to intermediate LSOs where demand may be sufficiently aggregated to justify facility construction. Where self-provided facilities are not economic, then the alternative is to use ILEC special access.

ILEC special access employed for connecting a remote LSO to a hub will typically be simple DS3 interoffice transport (*i.e.*, neither access multiplexing nor channel terminations are assumed necessary).[15] This access can be obtained on a month-to-month basis or via a term/volume commitment that affords lower charges in recognition of time and/or volume commitments. The price structure generally incorporates both fixed and per-mile monthly recurring and per-circuit non-recurring

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The total investment is, therefore, $8,500+$92,650 for the test access. Because the power distribution can be used for other equipment, it was prorated based on the assumption that 1 DLC frame represents a 5% load on the power frame. Thus, four DLC (12 frames) are assigned 12*.05* $62,500 for the power distribution bay ($37,500) for a total of $138,650. No maintenance costs or net salvage are assumed, so the monthly investment recovery is $3,082 before taxes and $3,113 after the tax adjustment. The $0.43 figure is the result of dividing $3,113 by (8,064 lines * 90% fill).

[13] *See* AT&T *ex parte* letter from Joan Marsh dated –November 25, 2002 explaining competitive costs of facility construction. In that case, the monthly cost was estimated at $32,557 for 48 DS3s of capacity. However, this figure includes collocation costs that would also largely be reflected in the DS0 infrastructure. Removing the entirety of the collocation cost from the transport figure (which actually reduces the figure too much, because space is required for the placing of the optical multiplexers and associated terminating equipment), the monthly cost for the transport would be $24,607. If this figure is divided by the practical capacity of an OC48 (90%*48) or 44 DS3s, the minimum backhaul cost is $559 per DS3 per month. Because each DS3 can carry 672 voice conversations and a 4-to-1 concentration is assumed, the cost of self-provided backhaul is a minimum of $0.21 per line per month ($559/2,688).

[14] In fact the RBOC's indicate only 13% or about 1 out of every 8 LSOs have any fiber-based collocators. (see UNE-Fact Report, page III-2)

[15] ILEC special access is not used in this example because it is the preferable means for connecting the collocations. Rather it is assumed because it, rather than DS3 UNE transport, is generally the only option that is practically available.

charges. RBOC charges, particularly by element, are quite variable.[16] Nevertheless, for purposes of this analysis, a reasonable estimate of the access cost function is $480.26 in fixed cost and $54.69 per mile.[17] This represents the cost of connectivity between the customer's LSO (where the DS0 equipment is collocated) and the hub collocation where the ring facility is accessed. The LSO-to-hub backhaul minimum cost is in the range of ($0.19+$0.021 per mile) per line per month for the access component.[18] When combined with the hub-to-switch backhaul, the monthly per-line cost increases to $0.40+$0.021 per mile. A 5-mile minimum backhaul assumption is not unreasonable.[19] Thus, the minimum backhaul cost is about $0.50 per line per month.

Customer Transfer Costs:

After the physical infrastructure described above is established, the CLEC must still incur the cost of disconnecting the customer from the ILEC network and then reconnecting the customer to the CLEC backhaul infrastructure.[20] This process is referred to as a hot cut. Hot cut charges are set at widely varying levels throughout the country. For this analysis, the cost of the hot cut is assumed to be $28.43 per line converted.[21] The cost of coordinating the transition on the part of the CLEC is less well-

[16] Long-term commitments for DS3 access, across RBOC territories, entail NRCs that vary from 0-$305, fixed charges that vary from $240 to $756 per month and mileage charges that vary from $27 to $101 per mile. Note that the low fixed and low per-mile charges do not necessarily occur in the same region.

[17] This cost was developed by first amortizing the non-recurring charge by RBOC region, and then combining it with the applicable monthly fixed charge. The cost of a DS3 was then calculated for circuits in 1-mile increments starting at 1 mile and continuing through 10 miles. The resulting regional circuit costs were then weighted together based upon the proportion of collocations that AT&T has active in those RBOC regions. The weighted average circuit costs were then regressed to produce the access cost function estimate employed here.

[18] The calculation is [$480.26 fixed + $54.69 per mile]*(1.01 to adjust for taxes)/ (672*4 line capacity). For comparative purposes, the special access segment, assuming 5 miles of interoffice transport is $0.294 per month per line. The minimum self-provisioned facility cost was previously quantified at $0.21 per line per month. Thus, special access charges are about 40% higher than economic costs. This is well within the range of figures previously submitted to the Commission. Assuming that UNE DS3 transport was widely and practically available, the CLEC cost disadvantage could be reduced by about $0.084 per line per month.

[19] A switch can easily serve loops using all-copper facilities if the loops are under 12,000 feet. Accordingly, the serving radius of such a central office is 12,000 feet and two contiguous offices would be about 25,000 feet or 4.5 miles apart. Special access mileage is rounded to the next whole integer of miles, which produces the 5-mile figure.

[20] In addition, if the customer elects to retain the telephone number used with the incumbent, then the CLEC must incur the cost of a number port.

[21] Based upon hot cut charges in effect in 33 states at mid-year 2002, the mean charge was $44.37. Assuming comparable processes and that these 33 states represented a random sample of a normally distributed population, the hot cut charge could be expected to fall in the range of $28.43 and $60.31 at a 95% level of confidence. Use of this figure should not, however, be construed as AT&T's agreement regarding the efficient costs of a hot cut process.

known. Nevertheless, the costs are certainly non-zero. Accordingly, this study assumes that the CLEC cost is the low end of the range for the expected hot cut charge, or $28.43 per transfer for a total minimum transition cost of $56.86 per conversion.

Because the transfer is a one-time cost, it must be amortized over the life of the customer account. An account life of 36 months is assumed, yielding a minimum monthly cost or $2.05 per line transitioned.[22]

Hypothetical Minimum Total Cost Disadvantage:

The hypothetical lowest cost disadvantage of an extremely efficiently operated CLEC (i.e., one deploys only high volume and high utilization collocations) can now be quantified as the sum of the preceding figures. In reality, no CLEC will experience these individual minimum cost impairment levels, much less experience multiple of them simultaneously in a single location.

	Hypothetical Minimum Cost Disadvantage Per Month Per Line
Cost of Space:	$0.73
Cost of Equipment:	$2.73
Backhaul Infrastructure:	$0.21 to $0.71
Customer Transfer Costs:	$2.05
Total:	$5.72 to $6.22

Potential Cost Offsets:

CLECs have only one potential cost offset in such cases.[23] Because the majority of the ILEC loops terminate on an analog switch port while the entirety of the CLEC termination would be digital, the ILEC potentially incurs a higher switch port cost. This cost offset amounts to no more than about $0.42 to $0.57 per line per month.[24] Thus,

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[22] The calculation is PMT(22.02%/12,36,-2*(28.43))*1.01. Multiplication by 1.01 includes the effects of non-income related taxes.

[23] Some parties assert that CLECs can gain scale economies by deploying larger switches. As AT&T demonstrated in its November 25, 2002 *ex parte* describing the costs of replicating unbundled loops, any scale economies that may be theoretically achievable are more than offset by the CLEC backhaul inefficiencies that are *not* reflected in this analysis.

[24] Notably, the Commission previously disallowed any cost offset for ILECs that employ digital loop carrier (*See* 10th Report and Order CC Docket 96-45 and 96-160 released November 2, 1999 ¶. 327), which argues against including any such adjustment in this analysis. Nevertheless it is included here for completeness. HAI inputs indicate that there is an investment saving of $30/line for loops that do not need to be digitized at the switch (*See* HAI inputs 5.2, page 86). Currently about 42% of ILEC loops are on some form of digital loop carrier (*See* ARMIS 2001 data from Table 43-07 II (using the sum of rows 383 and 390, divide by row 370), which means 58% of ILEC lines are served using higher cost analog ports.

taking into account the most conservative but still reasonable cost considerations, the CLEC disadvantage when providing DS0 service is can *never be less than* $5.14 to $5.64 per month per line based upon the high end of the offset range.

Realistic Appraisal of the Cost Disadvantage:

The preceding discussion quantifies the *minimum* cost disadvantage that *potentially* could occur when a CLEC attempts to provide voice service to a customer using an analog voice grade loop. But such level of cost disadvantage is much less than what will *likely* occur in practical market operation. For example, no CLEC is likely to serve an individual office and capture the optimal share so that it can fully utilize (1) the equipment collocated in the LSO, (2) the collocation itself and (3) and the connecting transport facility.[25] Furthermore, because collocation and hot cut charges vary from state to state, and sometimes substantially, and because backhaul transport charges display similar variability, it is extremely unlikely that the lowest charges for each of these necessary inputs (or even the average) will be simultaneously experienced by a CLEC operating within a particular LSO.

In order to facilitate a more accurate and granular analysis of these varying inputs, AT&T has designed a spreadsheet that accommodates these variations by applying the analysis discussed above to the actual data for *each* of the more than 8,000 RBOC LSOs. First, eligible lines (*i.e.*, residential and single/multi-line business lines) were identified for each LSO. Then, key costs that vary by LSO or RBOC (*i.e.*, collocation, hot cut and special access charges) were identified. Based upon other user-controlled input (*e.g.*, average office share captured, minimum office size penetrated, etc.) the model identifies the efficient equipment necessary to serve the demand in the LSO and quantifies the efficient costs of collocation and backhaul. Finally, the resulting cost of the incremental (compared to the ILEC) backhaul infrastructure necessary to provide a UNE-L service for low volume users in the specific serving office are divided by the lines served in the office to yield a monthly cost disadvantage per line.

The overall results from applying the algorithm to each LSOs, assuming the CLEC attains a 5% average share and serves LSOs of 5,000 lines or larger,[26] is a net CLEC cost disadvantage of at least $7.41 per line per month.[27] Thus, the minimum cost

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Using these data and treating the investment in a consistent manner, a cost offset of $0.32 per line results from the following computation: [PMT(22.02%/12,8.0*12,-30*.58) + 30*.58*(2%/12)]*1.01. Even if one assumes 50% of the DLC is UDLC, the impact is not significant – the offset would only be $0.43.

[25] Likewise, no CLEC is likely to have access to capital at the same cost of money as the ILEC or to be able to develop a business plan based on the relatively long asset lives that an incumbent can realistically use.

[26] In offices below 5,000 lines, a 5% share of eligible lines would mean the CLEC serves only 250 customers. In such cases there is no conceivable way that the additional costs of deploying a competitive switch would not be prohibitive. .

[27] This figure of $7.40 is the sum of $4.72 for collocation space preparation, rental and installed equipment; $0.84 for backhaul; $2.44 for hot cut costs; and an offset of $0.60 for digital switch termination.

disadvantage described above is only about seventy to seventy-five per cent of the *average* cost disadvantage that can be actually expected in the market. However, even this figure is misleadingly low because of the wide variety of office conditions that underlie it. A CLEC's cost disadvantage is highly influenced by the number of lines addressed within an end office. In fact, the CLEC disadvantage ranges from more than $12 per line for offices in the range of 5,000 to 10,000 lines to just under $6.00 per line per month for offices larger than 125,000 lines. Thus, the average masks a two-fold swing in costs.

Because the model performs its analysis on an LSO-specific basis, it is possible to examine the cost disadvantage, by office size, and on an ILEC and state specific basis.[28] The LSO-specific results (net cost disadvantage per line) were extracted and plotted in comparison to the lines served for the larger states. The result of the scatter plot was regressed to produce an equation that estimated the CLEC cost disadvantage, by state, based upon the number of lines served.[29] Illustrative results follow:

CLEC cost disadvantage per line per month = A * (lines served)^{B}

State	A value	B value	R squared
NY	56.808	-0.2600	0.8740
MA	54.677	-0.2734	0.8584
MI	102.41	-.03693	0.9392
CA	46.953	-.2682	0.9077
TX	70.338	-0.3176	0.9138
CO	70.536	-0.2863	0.9056
AZ	58.761	-0.1970	0.8448
GA	42.316	-0.2400	0.8890
FL	35.153	-0.2249	0.8650

Note : Because the modeling did not consider offices with fewer than 250 lines in service (5% share of a 5,000 line office), the preceding equations should not be used to estimate the cost disadvantage when fewer than 250 lines are served in an office.

These equations (and similar ones for other states) can serve to illustrate the range of cost disadvantages experienced by CLECs. A number of illustrations are provided in the tables contained in Appendix A.

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[28] Because such detail would be highly proprietary with regards to AT&T operations, the model software provided to the Commission masks the identification of the RBOC, state and CLLI but still represents the data at the LSO-specific level. That is, more than 8,000 locations are analyzed, but the specific location for each record is suppressed.

[29] The equation applied was uniformly: cost disadvantage per line = constant$_1$/[(lines)^constant$_2$ or in traditional linear regression terms: $y=bx^{-m}$. The R-squared was always in the range of 0.85 to 0.95, indicating a fairly strong correlation.

Although the tables in Appendix A show that the CLEC cost impairment is substantial in terms of absolute dollars, they do not by themselves establish the severity the disadvantage.[30] However, the severity of the cost disadvantage can be assessed by comparing it to the ILEC's economic costs for providing the inputs to the relevant service (here POTS) as measured by the TELRIC rates for the UNEs used to provide the service. AT&T has, for other purposes, developed the costs of UNE-P for various states according to the density zones implemented in the states. The costs are a reasonable representation of the state-approved assessment of the incumbent's efficient cost of providing service. These costs are defined by state and density zone. Because it is feasible to identify the applicable density zone for each LSO in each state, it is likewise feasible to identify the UNE-P cost of providing POTS service by LSO. And because the cost disadvantage is derived at the LSO level, it is possible to express the cost disadvantage in terms of the relevant ILEC local service cost for the office (*i.e.*, the CLEC cost disadvantage in an LSO divided by the UNE-P cost for that same office).

Once the percentage cost disadvantage is established for the LSO, it is a simple matter to summarize the number of end user lines based upon the percentage cost disadvantage that the CLEC would experience in competing for those lines. As AT&T has shown elsewhere, the Department of Justine's *Horizontal Merger Guidelines* suggest that a competitive cost disadvantage of 5% of the total cost of providing a service is a substantial entry barrier.

When the cost disadvantages are summarized for the various RBOCs, it becomes evident that, under current market conditions that require hot cuts, collocation and transport to substitute for the ILEC cross-connect across the main distribution frame, ***no*** CLEC is likely ever to provide UNE-L based service to a customer served by an analog voice grade loop. Regardless of the RBOC, there are no situations identified where the CLEC will operate with less than a 10% cost disadvantage.

CLEC Cost Disadvantage	**Percentage of RBOC Lines Above Limit**						
upper limit	Ameritech	Pac Tel	SWBT	BellSouth	Qwest	Verizon	total
10%	100%	100%	100%	100%	100%	100%	100%
20%	100%	100%	100%	99%	96%	100%	99%
30%	100%	94%	84%	77%	71%	83%	85%
40%	91%	77%	42%	19%	46%	43%	51%
50%	68%	20%	16%	4%	21%	16%	23%
60%	25%	4%	9%	1%	5%	2%	7%
70%	14%	1%	2%	0%	1%	1%	3%
80%	8%	1%	1%	0%	0%	0%	1%
90%	4%	0%	0%	0%	0%	0%	1%
100%	2%	0%	0%	0%	0%	0%	0%

[30] The costs displayed in the table are impairments with respect to the backhaul of analog loops to the CLEC switch. Other cost and operational impairments may also exist that are not accounted for in the estimation

As shown in the preceding table, there are no RBOC LSOs where CLECs will experience *less than* a 10% cost disadvantage. Indeed, the above table shows that only *half* of all RBOC lines are addressable by CLECs even at *a 40% cost disadvantage*. Furthermore, less than a *quarter* of each RBOC's lines are addressable by CLECs suffering a crippling *30% cost disadvantage*.

The above analysis definitively shows that, without UNE-P or the implementation of a fundamentally different loop access architecture such as is implicit in an electronic loop provisioning environment, unbundled local switching and UNE-P must continue to be available because of the severe economic impairment CLECs face in attempting to provide service using analog loops and a facility based CLEC core network.

Appendix A
Illustrative CLEC Cost Disadvantages Per Line Per Month
Assuming 5% Share Per Office

	CLEC Impairment: SBC States								
LSO size	CLEC lines in office (5% share)	MI	IL	IN	OH	WI	CA	TX	MO
10,000	500	$ 10.32	$ 9.66	$ 10.64	$ 11.81	$ 12.59	$ 8.87	$ 9.77	$ 10.59
20,000	1,000	$ 7.99	$ 7.85	$ 8.53	$ 9.09	$ 9.77	$ 7.36	$ 7.84	$ 8.68
30,000	1,500	$ 6.88	$ 6.95	$ 7.50	$ 7.80	$ 8.43	$ 6.60	$ 6.89	$ 7.72
40,000	2,000	$ 6.18	$ 6.38	$ 6.84	$ 6.99	$ 7.59	$ 6.11	$ 6.29	$ 7.11
50,000	2,500	$ 5.69	$ 5.96	$ 6.37	$ 6.43	$ 6.99	$ 5.76	$ 5.86	$ 6.67
60,000	3,000	$ 5.32	$ 5.65	$ 6.02	$ 6.00	$ 6.54	$ 5.48	$ 5.53	$ 6.33
70,000	3,500	$ 5.03	$ 5.39	$ 5.73	$ 5.66	$ 6.18	$ 5.26	$ 5.27	$ 6.05
80,000	4,000	$ 4.79	$ 5.18	$ 5.49	$ 5.38	$ 5.89	$ 5.08	$ 5.05	$ 5.82
90,000	4,500	$ 4.58	$ 5.00	$ 5.29	$ 5.15	$ 5.64	$ 4.92	$ 4.86	$ 5.63
100,000	5,000	$ 4.41	$ 4.85	$ 5.11	$ 4.95	$ 5.43	$ 4.78	$ 4.70	$ 5.46
110,000	5,500	$ 4.26	$ 4.71	$ 4.96	$ 4.77	$ 5.24	$ 4.66	$ 4.56	$ 5.31
120,000	6,000	$ 4.12	$ 4.59	$ 4.82	$ 4.62	$ 5.08	$ 4.55	$ 4.44	$ 5.18
130,000	6,500	$ 4.00	$ 4.48	$ 4.70	$ 4.48	$ 4.93	$ 4.46	$ 4.33	$ 5.06
140,000	7,000	$ 3.89	$ 4.38	$ 4.59	$ 4.35	$ 4.80	$ 4.37	$ 4.23	$ 4.96

Shaded areas are those office sizes which do not exist in a particular state and, as a result the cost disadvantage is only theoretical

Median Office Size (Business + Residence Lines) is About 4,000 lines in SWBT, 7,600 lines in Ameritech and 11,600 lines in Pac Tel territories

	CLEC Impairment: Verizon States						
LSO size	CLEC lines in office (5% share)	NY	MA	NJ	VA	PA	MD
10,000	500	$ 11.29	$ 10.00	$ 9.35	$ 8.91	$ 8.93	$ 9.03
20,000	1,000	$ 9.43	$ 8.27	$ 8.07	$ 7.20	$ 7.15	$ 7.38
30,000	1,500	$ 8.48	$ 7.40	$ 7.40	$ 6.35	$ 6.28	$ 6.56
40,000	2,000	$ 7.87	$ 6.84	$ 6.96	$ 5.82	$ 5.73	$ 6.04
50,000	2,500	$ 7.43	$ 6.44	$ 6.64	$ 5.43	$ 5.33	$ 5.66
60,000	3,000	$ 7.09	$ 6.13	$ 6.38	$ 5.14	$ 5.03	$ 5.37
70,000	3,500	$ 6.81	$ 5.87	$ 6.18	$ 4.90	$ 4.79	$ 5.13
80,000	4,000	$ 6.57	$ 5.66	$ 6.00	$ 4.70	$ 4.59	$ 4.94
90,000	4,500	$ 6.38	$ 5.48	$ 5.85	$ 4.53	$ 4.42	$ 4.77
100,000	5,000	$ 6.20	$ 5.33	$ 5.72	$ 4.39	$ 4.27	$ 4.63
110,000	5,500	$ 6.05	$ 5.19	$ 5.61	$ 4.26	$ 4.14	$ 4.50
120,000	6,000	$ 5.92	$ 5.07	$ 5.51	$ 4.15	$ 4.03	$ 4.39
130,000	6,500	$ 5.79	$ 4.96	$ 5.41	$ 4.05	$ 3.93	$ 4.29
140,000	7,000	$ 5.68	$ 4.86	$ 5.33	$ 3.96	$ 3.83	$ 4.20
150,000	7,500	$ 5.58	$ 4.77	$ 5.25	$ 3.88	$ 3.75	$ 4.12
160,000	8,000	$ 5.49	$ 4.68	$ 5.18	$ 3.80	$ 3.67	$ 4.04
170,000	8,500	$ 5.40	$ 4.61	$ 5.11	$ 3.73	$ 3.60	$ 3.97
180,000	9,000	$ 5.32	$ 4.54	$ 5.05	$ 3.66	$ 3.54	$ 3.90
190,000	9,500	$ 5.25	$ 4.47	$ 4.99	$ 3.60	$ 3.48	$ 3.84
200,000	10,000	$ 5.18	$ 4.41	$ 4.94	$ 3.55	$ 3.42	$ 3.79
210,000	10,500	$ 5.12	$ 4.35	$ 4.89	$ 3.50	$ 3.37	$ 3.73

Shaded areas are those office sizes which do not exist in a particular state and, as a result the cost disadvantage is only theoretical

Median Office Size (Business + Residence Lines) is About 7,000 lines

	CLEC Impairment in Qwest States						
LSO size	CLEC lines in office (5% share)	AZ	CO	MN	ID	OR	WA
10,000	500	$ 17.27	$ 11.90	$ 9.20	$ 11.85	$ 13.68	$ 8.68
20,000	1,000	$ 15.07	$ 9.76	$ 6.69	$ 9.44	$ 11.73	$ 6.62
30,000	1,500	$ 13.91	$ 8.69	$ 5.56	$ 8.27	$ 10.72	$ 5.65
40,000	2,000	$ 13.15	$ 8.00	$ 4.87	$ 7.52	$ 10.06	$ 5.05
50,000	2,500	$ 12.58	$ 7.51	$ 4.40	$ 6.99	$ 9.57	$ 4.63
60,000	3,000	$ 12.14	$ 7.13	$ 4.04	$ 6.58	$ 9.19	$ 4.31
70,000	3,500	$ 11.77	$ 6.82	$ 3.77	$ 6.26	$ 8.88	$ 4.06
80,000	4,000	$ 11.47	$ 6.56	$ 3.54	$ 5.99	$ 8.62	$ 3.85
90,000	4,500	$ 11.20	$ 6.35	$ 3.36	$ 5.76	$ 8.40	$ 3.68
100,000	5,000	$ 10.97	$ 6.16	$ 3.20	$ 5.57	$ 8.21	$ 3.53

Shaded areas are those office sizes which do not exist in a particular state and, as a result the cost disadvantage is only theoretical

Median Office Size (Business + Residence Lines) is About 3,900 lines

	CLEC Impairment: BellSouth States				
LSO size	CLEC lines in office (5% share)	GA	FL	LA	TN
10,000	500	$ 9.52	$ 8.85	$ 9.67	$ 10.53
20,000	1,000	$ 8.06	$ 7.59	$ 7.85	$ 8.66
30,000	1,500	$ 7.32	$ 6.94	$ 6.95	$ 7.72
40,000	2,000	$ 6.83	$ 6.51	$ 6.37	$ 7.12
50,000	2,500	$ 6.47	$ 6.19	$ 5.96	$ 6.68
60,000	3,000	$ 6.19	$ 5.95	$ 5.64	$ 6.35
70,000	3,500	$ 5.97	$ 5.75	$ 5.39	$ 6.08
80,000	4,000	$ 5.78	$ 5.58	$ 5.18	$ 5.85
90,000	4,500	$ 5.62	$ 5.44	$ 5.00	$ 5.66
100,000	5,000	$ 5.48	$ 5.31	$ 4.84	$ 5.49
110,000	5,500	$ 5.36	$ 5.20	$ 4.70	$ 5.35
120,000	6,000	$ 5.25	$ 5.10	$ 4.58	$ 5.22

Shaded areas are those office sizes which do not exist in a particular state and, as a result the cost disadvantage is only theoretical

Median Office Size (Business + Residence Lines) is About 6,300 lines